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HIGHLY PATHOGENIC AVIAN INFLUENZA IN DOMESTIC POULTRY AND WILD BIRDS: A RISK ANALYSIS FRAMEWORK[1]

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ABSTRACT: Animal disease surveillance implies the collection of information related to the occurrence of disease and the implementation of actions for prevention, control, and eradication. In the case of highly pathogenic avian influenza (HPAI) subtype H5N1, surveillance in wild birds is an important component of a comprehensive surveillance program to generate information that should lead to specific actions. Few, if any, of these actions are or should be directed toward wild birds; the vast majority are applied to the domestic poultry sector. A comprehensive surveillance plan should address four key areas: early warning, prevention, detection, and emergency response. The paper addresses these components in light of HPAI. Risk analysis for HPAI is broadly outlined with particular emphasis on risk-management strategies, including compartmentalization based on the World Organization for Animal Health (OIE) guidelines.

Key words: Highly pathogenic avian influenza, risk analysis.

The introduction of highly pathogenic avian influenza virus (HPAI) into the domestic poultry population of a country can have devastating consequences. Risk analysis can help determine the likelihood of HPAI introduction and its associated consequences. Further, risk management will assist the decision-maker in selecting the most efficient risk mitigation measures as part of a comprehensive, integrated strategy considering populations of wild birds and domestic poultry. Risk analysis is a process comprising four interrelated steps (OIE, 2005): hazard identification, risk assessment (including release assessment, exposure assessment, consequence assessment, and risk estimation), risk management, and risk communication.

Hazard identification aims at identifying the adverse event of concern. In this case the hazard can be defined as the introduction of HPAI H5N1 into the domestic poultry population.

Risk assessment is defined as the evaluation of the likelihood of entry, establishment, and spread of a disease, in conjunction with the associated potential biological, economic, and public health consequences (World Trade Organization [WTO], 1995; OIE, 2005).

Release assessment seeks to identify the potential pathways for disease introduction. The HPAI H5N1 can be introduced via wild birds or by trade in poultry and poultry products. Wild bird monitoring will contribute to a timely detection. It is worth noting that a positive finding in wild birds does not necessarily mean that the domestic poultry population will become infected. Biosecurity plays a central role in preventing the introduction of the virus into domestic poultry. Legal trade of poultry and poultry products should be considered safe if the import requirements are based on the OIE recommendations (OIE, 2005). The real problem lies in illegal trade of poultry products as well as live birds, including pet birds, fighting cocks, falcons, and other hobby birds. These bird movements are extremely difficult to control.

Success in achieving an early detection of the presence of HPAI relies on the implementation of an effective surveillance system. Surveillance can be defined as information for action (Salman, 2003). In the case of surveillance for the HPAI H5N1, an integrated comprehensive approach is required. Four main components of an effective surveillance system have

been identified: early warning, prevention, detection, and emergency response.

Early warning: Many surveillance systems have enhanced surveillance for HPAI in wild birds and domestic poultry. Monitoring for the virus in these populations provides information that will contribute to early detection in domestic poultry. This information is currently captured by several organizations and distributed globally. The two main sources for official information on the occurrence of HPAI are the OIE and the Food and Agriculture's Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES).

Although there are many information sources that cover avian influenza, several are unofficial and some may not be trustworthy. Others, like the International Society for Infectious Diseases' Program for Monitoring Emerging Diseases (Promed) strive to verify the information posted and contribute significantly in providing accurate and up-to-date reports. Direct communication between countries that share common borders or other epidemiological links is essential to limit the spread of HPAI in the domestic bird population.

Prevention: As mentioned above, surveillance should trigger specific activities aimed at the control and eventual eradication of diseases. Monitoring for HPAI in wild birds will generate information, but few, if any, of the actions adopted are directed to these populations. Most of the actions are directed to the domestic poultry population, where biosecurity is the key element. Although biosecurity can easily be improved in the commercial poultry sector, it is not as simple to improve in a subsistence-farming environment. Nevertheless, some practical measures can be adopted through biosafety education.

Detection: Early detection is crucial to take appropriate and timely measures to prevent the spread of avian influenza. Detection in wild birds requires knowledge of the migratory pathways and resting sites. The United States Geological Service (USGS) bases its wild bird surveillance on five strategies (USGS, 2006): investigation of disease events in wild birds, expanded monitoring of live wild birds, monitoring of hunter-killed birds, environmental sampling of water and bird faeces, and use of sentinel animals such as backyard poultry flocks.

Surveillance in domestic poultry should be directed toward high-risk populations. The definition of high-risk populations may vary from country to country but in general will include domestic poultry kept outdoors (especially those in close proximity to wild bird sites), normal daily mortality in commercial farms, and unusual mortality in commercial or backyard flocks.

Exposure assessment aims at determining the potential pathways leading to exposure of susceptible birds. A finding of HPAI in wild birds does not imply that domestic birds will become infected. Pathways to domestic birds include direct contact with infected wild birds (for example, domestic poultry in proximity to wild bird populations), indirect contact with infective material (for example, fomites such as contaminated equipment and clothes, cats carrying dead infected wild birds), and contact with infected poultry or poultry products. Each pathway should be assessed individually to estimate the likelihood of introduction.

Risk is the probability of occurrence of the event and the magnitude of the consequences. The release and exposure steps deal with the probability of HPAI infection in domestic birds. *Consequence assessment* seeks to determine the severity of the event both in biologic and economic terms.

Risk management: The OIE recommends two disease management options in the event of the introduction of a disease:

regionalization and compartmentalization. Regionalization is a process by which populations of different health status are separated on the basis of geographical criteria, whereas compartmentalization distinguishes these populations on the basis of management and biosecurity (OIE, 2005).

If wild birds are infected with H5N1 virus, regionalization will be of limited use, as wild birds do not recognize the artificial boundaries delimiting the infected and free zones. Compartmentalization will be a more practical approach to limit the impact of an outbreak. Scott et al. (2006) identified seven factors in the implementation of compartmentalization: definition of the compartment; epidemiologic separation of the compartment from potential sources of infection; documentation of factors critical to the definition of compartment; supervision and control of the compartment; surveillance for the agent or disease; diagnostic capabilities; and emergency response, control, and notification capability.

The exposure pathways identified in the risk assessment should be ranked by order of importance (perceived risk). Biosecurity measures to address each pathway should be applied and monitored. Most biosecurity measures are disease independent and also will contribute in the prevention of other diseases. The key for a successful implementation of compartmentalization is a transparent process of official certification that will include a process akin to hazard analysis and critical control points (HACCP) applied to the monitoring of biosecurity (Zepeda, 2005).

Risk communication: Effective implementation of measures to prevent, control, and eradicate HPAI is dependent on the establishment of a communication strategy involving all interested parties. The economic impact of HPAI can be exacerbated by consumer fear. In November 2005, poultry consumption in Mexico declined by nearly 40% following press reports about HPAI in other countries. Industry and government reacted by providing timely and accurate information about avian influenza virus (Foreign Agricultural Service [FAS], 2006a). Although the impact was mitigated, it caused additional losses that could have been avoided.

The impact of HPAI in the European Union (EU) is expected to be minimal at about 1%. A report by the USDA Foreign Agricultural Service (FAS, 2006b) predicts that negative consumer reaction will be concentrated in certain countries of the EU. This may indicate that the communication strategy needs to be adapted to accommodate cultural differences.

In conclusion, surveillance for HPAI in wild birds will help predict the spread of the virus. Early detection is perhaps the single most important element that will minimize the impact of an HPAI introduction. Targeted surveillance directed to high-risk populations will be the most effective strategy both in wild and domestic birds. Risk analysis provides a structured framework on which to base a comprehensive disease prevention and control strategy. In this light, enhanced biosecurity and compartmentalization are the most effective tools for risk management.

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